

1993 $\frac{21}{B}$

A
BRIEF
INTRODUCTION
TO
GEOGRAPHY,

CONTAINING
A DESCRIPTION OF THE
Grounds, and general part thereof.

Very necessary for young Students
in that Science.

Written by that Learned Man, Mr. *William Pemble*,
M. A. Of *Magdalen Hall* in OXFORD.

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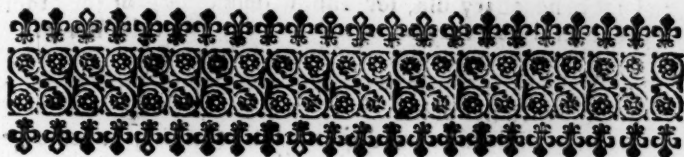


TO THE READER.

GEntle Reader ; I here present unto thy view these few sheets, written by that Learned man Mr. WILLIAM PEMBLE, I doubt not to call him the father, the child favours him so much. It hath long lain hid from thy sight, but now at length emboldned upon thy courteous acceptance of his former labours, it looks abroad into the World : It is but little, let not that detract any thing from it, there may lie much, though pen'd up in a narrow room ; when thou readeſt, then judge of it : Thus much may be ſaid ; Though many have writ of this ſubject, yet this inferiour to none ; thou maiſt obſerve in it, an admirable mixture of Art and delight, ſo that for younger Students it may be their Introduction, for others a Remembrancer, for any not unworthy the peruſal : onely, let it find kind entertainment at thy hands. Farewell.

TO THE READER

THESE are the first of the
works of the author, and
are intended to be a
series of papers, which
shall be published from
time to time, as they
are written, and shall
be continued as long as
the author shall have
any more to write.
The first of these papers
is a history of the
author's life, and is
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BRIEF INTRODUCTION
TO
GEOGRAPHY

CHAP. I.

A general description and division of Geography.

TOPOGRAPHIE is a particular description of some small quantity of Land, such as Landmeasures set out in their plots.

Chorography is a particular description of some Country, as of England, France, or any shire or province in them: as in the usual and ordinary map.

Geographie is an art or science teaching us the generall description of the whole earth, of this especially we are now to speak of, and also Chorography as a part under it contained; both, excellent parts of knowledge in themselves, and affording much profit and help in the understanding of history and other things. The parts of Geography are two.

General, which treateth of the nature, qualities, measure, with other general properties of the earth.

Speciall, wherein the severall countries and coasts of the earth are divided and described.

Of the general in the first place, and more at large then of the other, because it is more difficult and hard to be understood, and

and yet of necessary use, for the understanding of the other. This general tract may be parted into five particular heads.

1. Of the properties and affections of the earth.
2. Of the parts of it in general.
3. Of the Circles of it.
4. Of the distinction and division of it according to some general conditions and qualities of it.
5. Of the measuring of it.

These in their order.

CHAP. II.

Of certain generall properties of the earth.

IN Geography when we name the earth we meane not the earth taken severally by it self, without the seas and waters. But under one name both are comprised, as they are now mingled one with another and doe both together make up one entire and round body. Neither doe we dive into the bowels of the earth, and enter into consideration of the naturall qualities, which are in the substance of Earth and water, as coldness, dryness, moisture, heaviness, and the like: but we look only upon the outside, contemplating the greatness, situation, distances, measuring, and other such affections which appear in the superficies of it, to the eyes of our bodies and minds: These then of the earth and water together, rules are to be knowne:

1. *The earth and the water do make one globe, i.e. one round or sphericall body.*

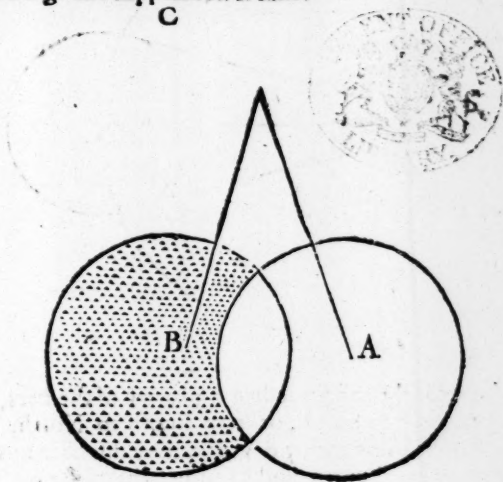
The naturall place of the water is to be above the earth, and so it was in the first creation of it, compassing the earth round about, as appears, *Gen. 1. 9.* But for the use of man and all other living creatures, God made a separation of them, causing the water to sink down into huge hollow channels, prepared to receive it, that so the drie land might appear above it. Notwithstanding which separation, they doe both still remain together, ~~not~~ covering one another as at first, but intermingled one with another, and that so exactly as they now make but one round body, whereas at first they made two. Here therefore are two points to be proved, 1. That they are one globe. 2. That this one is round.

1. They



I. They are one globe having the same Center or middle point, and the same surface or convexe superficies; which will appear by these reasons.

1. Common experience. Take a lump of earth and any quantity of water, and let them both fall down together upon the earth from some high place, we see that in the descent they do not sever; but keep still together in one streight line, which could not be, if the earth and water were two several round bodies having several centers. As for example, suppose them to be two globes, and let (a) be the center of the earth, and (b) the center of the water; from (c) some high place above the earth, hurle down earth and water, I say the earth will part from the water in going down, and the earth will fall down upon (d) and the water upon (e) but this is contrary to experience, and *ergo* the supposition is false.



E

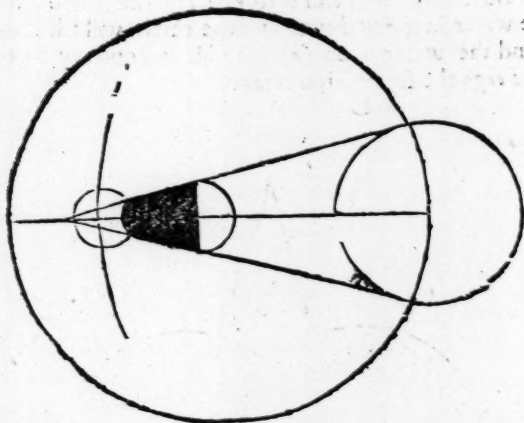
D

2. The shadow which in Eclipses is cast upon the Moon by the earth and the water, is but one and not two, and therefore the body is so likewise. This will appear in the proof of the next point, v. 2.

2. That

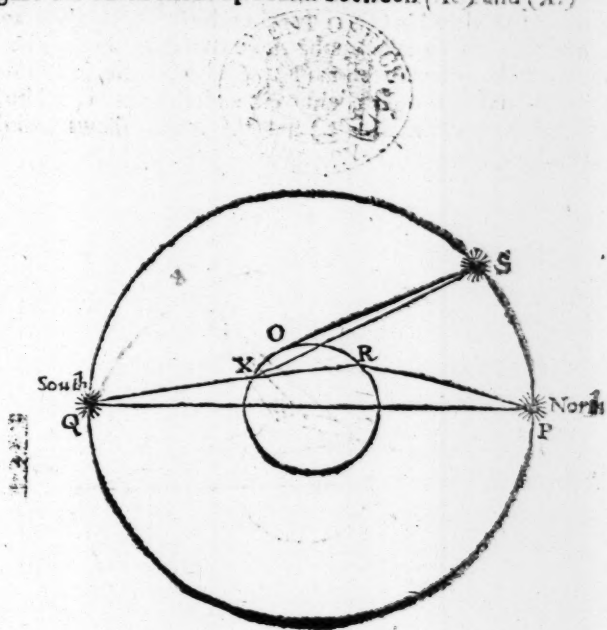
¶ That both earth and water are one round body, not square, long, hollow, or of any other figure. This is proved by divers reasons.

1. By Eclipses; when the earth stands juſt between the Sun and the Moon, then doth the ſhadow of the earth falling upon the Moon darken it wholly or in part. Now as is the faſhion of the ſhadow, ſuch is the figure of the body, whence it falls, but the ſhadow of the earth and water caſt upon the Moone is round, and alſo one, therefore they are round and alſo one body.



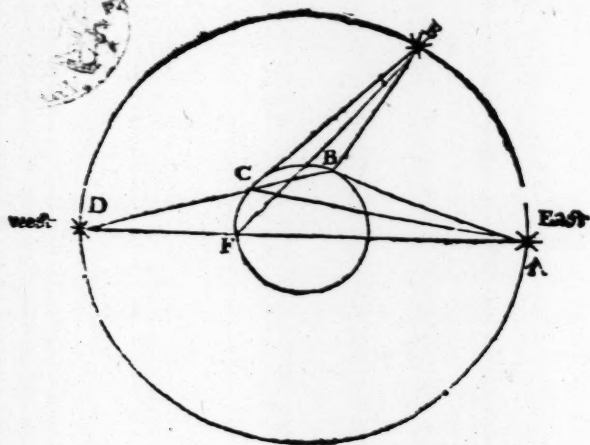
2. By the orderly and ſucceſſive appearing of the ſtars, as men travail from North to South, or from South to North, by Sea or land. For as they goe by degrees, they diſcover new ſtars, which they ſaw not before, and loſe the ſight of them they did, which could not be if the earth were not round. As for example, let (X.O.R.) the inward Circle be the earth, (Q.S.P.) the outward, the Heaven: they cannot ſee the ſtar (S) which dwell upon the earth in (X) but if they goe Northward unto (O) they may ſee it. If they go farther to (R) they may ſee the ſtarre (P) but then they loſe the ſight of the ſtar (Q) which being at (X) and

X) and (O) they might have seen. Because, as it appears in the figure the earth riseth up round between (R) and (X.)



3. By the orderly and successive rising of the Sun and stars and setting of the same. Which appear not at the same time to all countries, but unto one after another. As for example. let (F.C.B.) be the circle of the earth, (D.L.A.) the Circle of the heaven

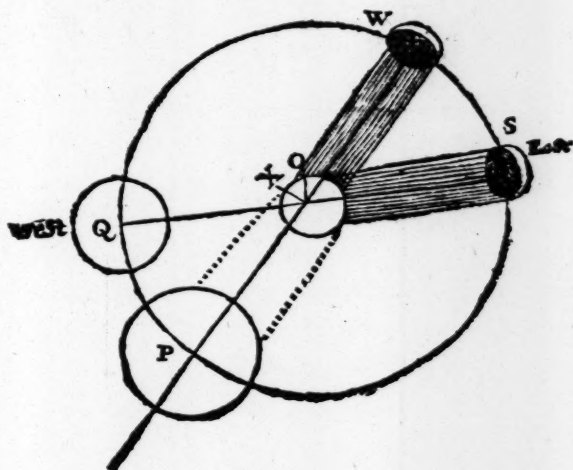
from East to West, let (A) be the Sun or a star. When the Sun (A) is up, and shines upon them that dwell in (B) he is not risen to them that dwell in (C) again when he is risen higher and is come to (E) and so shines upon those that dwell in (C) he is not yet up to them that dwell in (F) Again when he sets in the West, in (D) and so is out of sight to the inhabitants in (B) he is yet up to them that dwell in (C) and (F) Which shews plainly the earth is round.



4. By the different observations of Eclipses. One and the same Eclipse appearing sooner to the Easterly Nations then those that lye farther West; which is caused by the bulke of the earth swelling up between. As for example.

Let

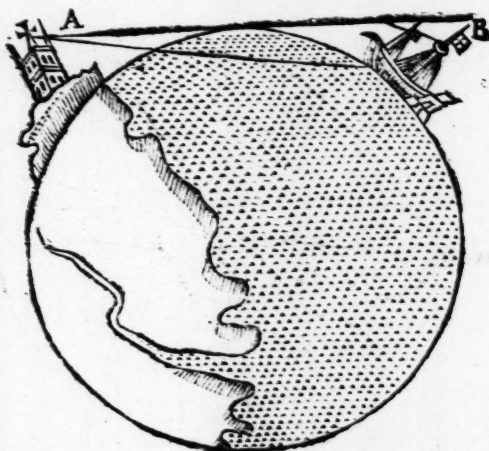
Let (XO) be the Circle of the earth, and the greater the Circle of the heaven from east to west. Let $(P.Q.)$ be the body of the Sun, $(W.S.)$ of the Moon in the eclipse by reason of the earth between it and the Sun. It is manifest that the inhabitants in (O) shall see the eclipse before the inhabitants in (X) by certain hours, according as the distance between (X) and (O) is more or less. They that dwell in (O) shall see it in (S) they that dwell in (X) see it not till it come to (W) a great deale higher.



5. That the water is round besides the natural weight and moisture of it, which being apt to yield and run abroad, will not suffer some places to lye high, and some low, like hills, and dales, but though it be made rough and uneven by tempest, doth presently return to their natural smoothness and evenness: I say besides this; it is cleare by common experience; for if we stand on

land, and see a ship go forth to sea, by degrees we loose the sight of it, first of the bulke, then of the mast, and all. So also on the other side they that are at Sea, by degrees doe lose or gaine the sight of the Land: As for example.

Let (A) be some steeple on the land (B) a ship at sea: He that stands at (A) shall by little and little lose the sight of the ship, as she goes out, and get sight of her as she comes in. Both first and last he shall have the sight of the top mast (B) when he sees nothing else, Because the sea riseth up between his sight and the ship.



These reasons and experiments may suffice to prove the roundness of the earth and water; which might be farther demonstrated by shewing the fallhood of all other figures regular or irregular that can be given unto it: that it is neither square, nor three cornerd, nor Pyramidall, nor conicall or Taperwise, nor Cylindricall like a barley rowie, nor hollow like a dish, nor of any other fashion, as some have imagined it to be of. We come to this second rule,

2. The tops of the highest hills, and bottoms of the lowest vallies although in several places they make the ear.b uneven, yet being compared

pared to the vast greatness of the whole, doe not at all hinder the roundness of it.

Among all Geometrical figures the sphericall or the round is the most perfect, and amongst all naturall bodies the heaven is the most excellent. It was therefore good reason the most beautifull body should have the most perfect and exquisite shape. Exact roundness then is not found in any body, but the Heavens; the earth is round as was shewed before, but not precisely, without all roughness and inequality of its surface. There are hills like warts, and vallies like wrinkles in a mans body; and that both for ornament and use. Yet is there such uniformity in this variety, as that there is no notable and sensible inequality made in the earth by hills and vallies. No more then if you should lay a fly upon a smooth Cart wheele, or a pins head upon a great globe. Now that this is so, appears by sense and reason. By sense thus, If we stand on a hill or in a plaine, when we may discerie the country round about 15 or 20 miles; we may behold the brim or edge of the earth round about us to be in a manner even and streight, even there, where the country is very hilly, and full of mountains. So that a far off their height makes but a little alteration and difference from the plain countries, when we behold altogether a far off: though when we come near; the alteration seems more sensible.

By reason thus, the thickness of half the earth (as shall be shewed) about 4000 miles, now the plumb height of the highest mountains, is not accounted above a mile and a half, or two miles at the most. Now between two miles and four thousand, there is no sensible proportion, and a line that is four thousand and two miles long, will not seem sensibly longer then that which is foure thousand; as for example. Let (O) be the center of the earth, (XW) a part of the circle of the earth which runneth by the bottoms of the hills and superficies of champion and even plains (WO) or (XO) is the semidiameter or halfe the depth of the earth (S) is a hill rising up above that plain of the earth (WS) is the plumb height of the hill. I say that (WS) doth not sensibly alter the length of the line (OW) ; for (WS) is but two miles, (WO) 4000 miles, and two to 4000 alters not much more, then the breadth of a pin to the length of a pearch. So a line drawn from (O) the center to (S) the top of the hill, is in a manner all one with a line drawn to (W) the bottome of the hill.



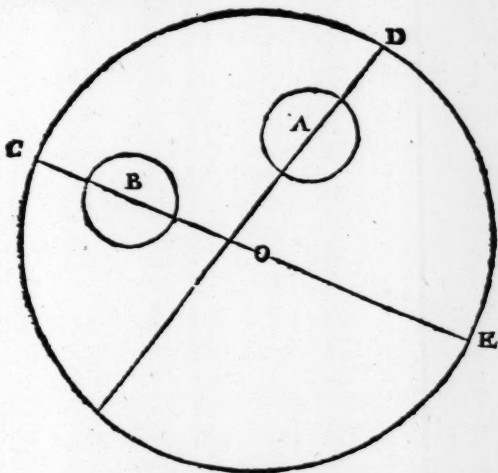
The third Rule.

3. The earth resteth immoveable in the very midst of the whole world.

Two points are here to be demonstrated, First that the earth standeth exactly in the midst of the world. Secondly that it is immoveable. The former is proved by these reasons.

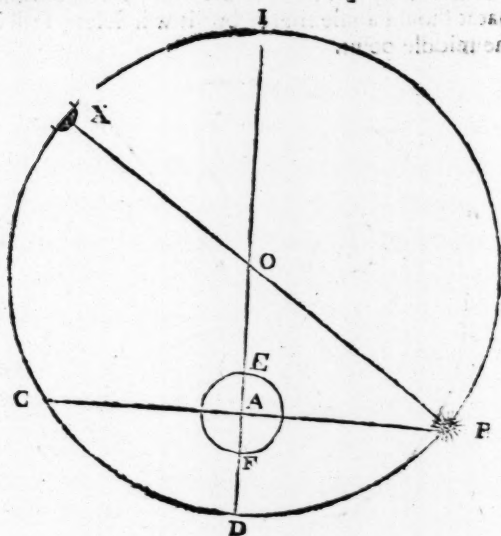
1. The naturall heaviness of the earth and water is such, as they will never cease moving downwards 'till they come to the lowest place; Now the center or middle point of the world is the lowest place, and *ergo* they must needs move thither as for example.

Let (O) be the center of the world, (CDE) the heavens: it is manifest that the lowest place from the heavens on all sides is (O) Suppose the earth to be in (A) or in (B) some where out of the center, I say it is not possible (unless it be violently held up) that it should abide there, but it will descend till it come to (O) the middle point.

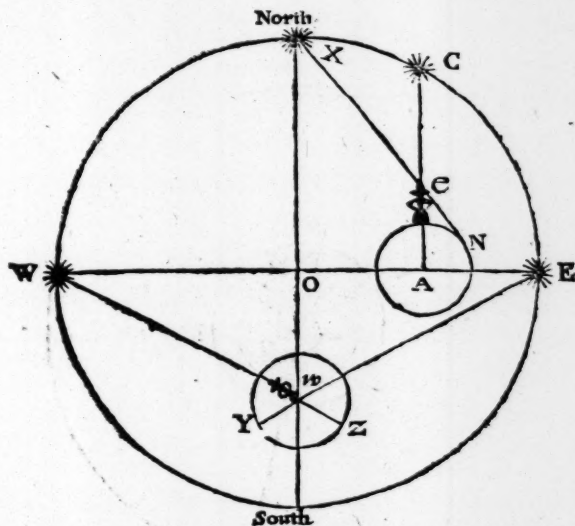


2. If the earth stood any where but in the midst we should not see half the heavens above us, as now we alway do, neither could

could there be any *Æquinox*, neither would the days and nights lengthen and shorten in that due order and proportion in all places of the world as now they do; again *Eclipses* would never fall out but in one part of the Heavens, yea the Sunne and Moon might be directly opposite one to another and yet no *Eclipse* follow, all which are absurd. As for example, let the center of the world be (O) let the earth stand in (A) a good way distant from the center, it is manifest that the greater half of the heavens (CIB) will always be above, and the lesser half (CDB) below, which is contrary to experience. Thence also it follows that the days and nights will never be equall, for the Sun (B) will be alwayes longer above the earth whilst he moves from (B) to (C) then below, moving from (C) to (B.) Again, the Sun (B) may stand just opposite to the Moon (X) and yet no *Eclipse* follow, the earth which makes the *Eclipse* standing out of the midst.



3. The shadows of all bodies on the earth would not fall into that orderly uniformity as they doe: for if the earth stood towards the East, the shadows would be shortest before noon, if toward the west after noon, if towards the North, the shadows would still fall Northward, if towards the South, Southwards, all which experience shewes to be false. As for example, let the earth stand Eastwards in (A) the shadow of any body upon the earth, as of the body under (E) will be shorter in the morning when the Sun is in (C) then at noon when the Sun is in (X) If the earth stand Southward in (B) the shadow of any body will always fall South, as it doth in the figure Y and Z,

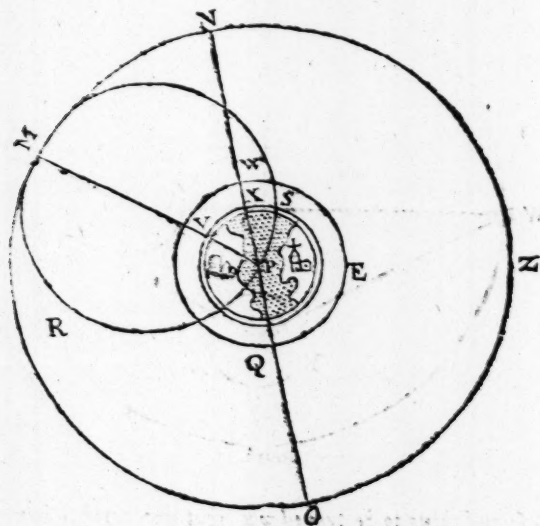


The second thing to be proved was that the earth is immoveable. Where we must understand a double motion, Streight, or Circular. For the first it is clear that without supernatural violence it cannot be moved in any streight motion, that is, upward, downward; or toward any side; it cannot be shoved out of his place.

C

For

For the Second, whether abiding still in his place it may not move round, the question is disputed, and maintained on both sides. Some affirm it may and doth; who think there is greater probability the earth should move round once a day, then that the Heavens should, by reason of the incredible swiftness of the heavens motion, scarce compatible to any naturall body; and the more likely slowness of the earths moving. Others deny it grounding their opinion upon Scripture, which affirms the earth to stand fast so as it cannot be moved; and upon Sense, because we perceive it not to move, and lastly upon reasons drawn from things hurled up, and let fall upon the earth. The arguments on both sides will be more easie to be understood by this figure.



In this figure it is manifest that the earth in the middest, cannot move by any streight motion, upward toward (N) or side-ward toward (M) or any other way out of its proper place, and therefore that opinion of *Copernicus* and others that the earth should

should move round once a year in such a circle as (MPR.) is most improbable and unreasonable. And rejected by the most.

But although it cannot move straight, it may move round. For though it be a marvellous great body of unconceivable weight, yet being equally poised on every side, there is nothing can hinder its circular motion; as in a Globe of lead, or any other heavy substance, though it were 40 Fadome in compass, yet being set upon his two Poles, it would easily be turned round, even with the touch of ones little finger. And therefore it is concluded that this circular motion is not impossible. The probability of it is thus made plain. The whole circuit of the heavens, wherein are the fixed stars, is reckoned by Astronomers to be 1017562500, that is, a Thousand and seventeen Millions of miles, five hundred sixty two thousand, and five hundred miles. Let this be the compass of the circle (NMOZ.) So many miles do the heavens move in one day, till the same point come to the place from whence it went; as till (N) move round, and come to (N) againe. This being the motion of the whole day 24 hours, how many miles will (N) move in one houre? it will move 42398437 and a halfe, i. e. Forty two Millions three hundred ninty eight thousand, four hundred thirty seven miles and a halfe. So many miles will (N) move in one hour, from (N) to (M.) A motion so swift that it is utterly incredible. Far more likely it is, the circuit of the earth (ASXV) being about 24000, i. e. twenty four thousand miles more or less, it should move round once a day. For then one point as (X) should move in one hour from (X) to (V) but a thousand miles, which motion although it be swifter then any arrow or bullet from a Canons mouth yet it is incomparably slower then that of the heavens, where so many millions are posted over in an hour.

Now for the salving of all the celestiall Phænomena, or appearances, the truth is the same, if we suppose the earth to move as if we believe it to stand still. The rising of the Sun and stars, the motions of all the Planets, will keep correspondence as now. Nor need we feare Jogging, or that steeples and towers would totter down, for the motion is regular, and steady without rubs and knocks. As if you turn a globe round it will goe steadily, and a fly will sit fast upon it, though you move it apace. Besides the

whole body the ayre is carried about with the whirling of the earth, so that the earth will make no wind, as it turns swiftly about; as a wheele will, if it be turned apace.

Notwithstanding all this, most are of another opinion, that the earth standeth still without all motion, rest rather befitting so heavy and dull a body then motion. The main reason brought to establish it is this. Let a stone be thrown down out of the ayre from (W:) if the earth stand still, it is manifest it will fall upon (X) just under it; as we see it doth. By common experience, a stone will fall down from any height upon the place we aimed at, but let the earth move, the stone will not light upon (X.) but some where else as on (S:) for (X) will be moved away, and gone to V.

So again let two pieces of ordinance that will shoot at equal distance be discharged one just towards the east, the other towards the West; if the earth move (as they say it doth) towards the West, the bullet that is discharged Eastward will fly farther then that Westward. For by the contrary motion of the earth he will gain ground. But experience hath proved this to be false shewing that the bullets will both fly at equal distance.

To salve this, answer is made that the earth by its swift motion carries with it, and steadily, not only all bodies resting or moving upon it, but also the whole Sphere of Aire (WEQ) with all things whatsoever that are moved in it naturally or violently, as clouds, birds, stones hurled up or down, arrowes, bullets, and such like things violently shot forth: as may appear in the figure.

The Fourth Rule.

4. The earth, though it be of exceeding great quantity being considered in it self, yet being compared to the heavens, especially the higher spheres, is of no notable bigness, but may be accounted as a point or prick in the midst of the world.

That the earth is no bigger then a point or pins head in comparison of the highest heavens will easily appear unto us, by these reasons.

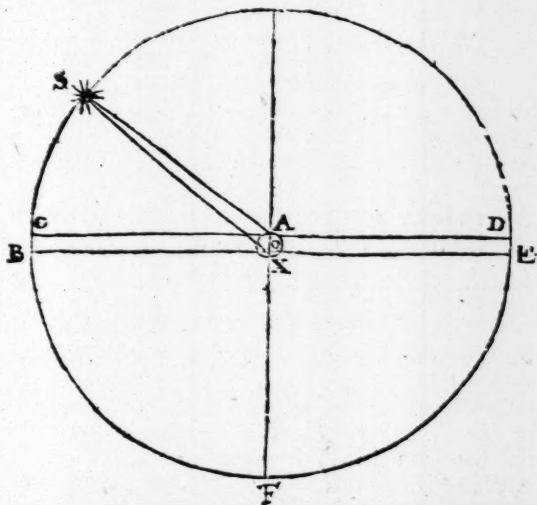
1. The stars which are many times bigger then the earth, seem yet to us to be no bigger then a great pins head, or such like

like quantity; therefore much less shall the earth appear to be of any sensible magnitude.

2. We always behold halfe the heavens above us, which could not be if the earth had any sensible proportion to the heaven.

3. All observations of heights and distances of the cœlestial bodies, which are made on the superficies of the earth, are as exact, and true, as if they were made in the very center of the earth. Which were impossible, unless the thicknesse of the earth were insensible in regard of the Heavens.

4. All Sun Dials which stand on the superficies of the earth, do as truly cast the shadows of the houres, as if they stood in the Center. As for example,



The starre (S) appears like a point or prick to them that dwell in (A) wherefore the earth (OX) will appear much lesse to the sight of him that should behold it from (S,) nay it would not be seen at all. Again, halfe the Heavens (BFE) are alwaies seen to them that dwell in (A) wanting some two minutes, between (ED) and (BC) which difference is altogether insensible. Again,

if we observe the height of the starre (*S*) above the Horizon (*BE*) it will be all one namely (*BS*) whether we observe it in the top of the earth, in (*A*) or in the middle in (*O*). For (*A*) and (*O*) are so little distant one from another, that (*AS*) and (*OS*) will be parallel lines, and be esteemed but as one line. The fourth reason concerning Dials, is cleare by the framing & construction of them: wherein either the lower end of the Cock (or Gnomon) whereat all the houre lines meet, or the upper end and knobb (as in many Dials) is supposed to be the Center of the earth,

C H A P. III.

Of the parts of the Terrestirall Globe.

THe properties of the earthly globe have been handled in the former chapter, we come now to the parts, which are two in general.

{ Earth }
{ Water }

Both contain under them more particular parts to be known.

The more notable parts of the Earth are these.

1. A Continent or maine Land, or as some called it firme Land, which is not parted by the sea running between.
2. An Island, a land compassed about with waters.
3. A Peninsula, a land almost surrounded by waters save at one place, where it joyne by a narrow neck of land to the Continent; this is also called Chersonesus.
4. An Isthmus, a streight neck of land which joyne two countries together and keeps the sea from compassing the one.
5. A Promontorie or head land running farre out into the sea like a wedge.
6. A Mountaine
7. A Valley
8. A Champion plain
9. A Wood

} All easie to be known without any definition.

The more notable parts of the water are these:

1. *Mare* the Sea, or Ocean, which is the gathering together of all waters.
2. *Fretum* a streight or narrow sea running between two lands.
3. *Sinus* a Creeke, Gulfe or Bay, when the sea runnes up into the bosome of the land by a narrow entrance, but openeth it broader

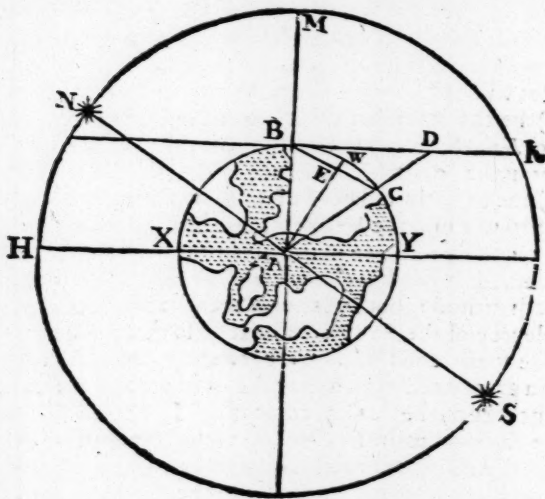
broader when it is within; if it be very little it is called a Haven, *Fertus*.

4. *Lacus* a Lake, a little sea within the land having rivers running into it, or out of it, or both. If it hath neither it is called *Stagnum* a standing Poole, also *Palus*, a fenne.

5. *Fluvius* a River, which from the pleasantnesse is also called *Amnis*. From the smalnesse of it *Rivus*.

Now concerning these parts divers questions are moved: whether there be more Sea or Land? whether the sea would naturally overflow the land, as it did in the first creation, were it not withheld within his banks by divine power? whether the deepnesse of the Sea, doth exceed the height of the mountains? whether mountains were before the flood? what is the height of the highest hills? whether Islands came since the flood? what is the cause of the Ebbing and flowing of the Sea? what is the original of Springs & Rivers? what manner of motion the running of the rivers is? with such like, whereof some belong not so properly to this science of Geography as to others. We speake onely a word or two of the last, and so proceed. The question is whether the motion of the rivers be streight or Circular. The doubts on both sides will best appeare by a figure first drawn; wherein, Let (HMO) be the meridian of *Alexandria* in *Egypt*, or of the mouth of *Nilus* & answerable to the Meridian of the Heavens. Another in the earth (XBY.) Let (B) be the mouth of *Nilus*, and (C) the fountain and head of it. Now the mouth of *Nilus*, where it runnes into the Mediterranean Sea, is placed by Geographers in the 31 degree of the North latitude; and the head of *Nilus* where it riseth is placed by *Ptolomeus* in 11. degree of the South latitude, but by latter & more exact Geographers in the 14 degree of the Southerne latitude, so that the distance between the founts and *Ostia*, i. e. between (C) and (B) is 45 degrees of a great circle, which after the usual account makes 2700. one eight part of the earths compasse; The question now is, whether the running from (C) to (B) runne continually downward in a streight line; or circularly in a crooked line. If it runne in a streight line, as is most agreeable to the nature of the water, it must move either by the line (CEB) or by the line (DB.) By the line (CEB) it cannot move: for when it is come to (E,) it will stand still. Because from (E) to (B) it must move upward, if it move

move at all, which is contrary to the nature of water. If therefore it move by a streight line it can be no other, but (BD,) and so from (D) to (B) it shall continually descend; for of all places between (D,) and (B) (B) is the nearest to (A.) But then the fountain must not be in (B) but higher in (D) which seems altogether improbable or impossible. For first the line (AD) would be notable and sensibly longer then the line (AB.) For the compasse of the earth being about 2400 miles, and the semidiameter (AB) or (AC) 3828 miles, the line (CD,) would be 1581 miles, which cannot be true, if, as we have proved before, the earth be round, and that the highest hills make no sensible inequality. Again they that dwell in (D) should see the North Pole star (N) as well as they that dwell in (B,) which also is false. So then the river cannot run either by (EB) or (DB,) Runnes it then circularly by the line (CWB?) This seems probable, and the rather because hereby a reason of the original of Rivers might more easily be



given. For the fountain (C) lying even with the superficies of the

the Sea the water may easily passe through the hollowes of the earth, and break out at (C) without ascending. But here also are some difficulties: for first we finde by experience that the fountaines of most rivers, and those great ones too, lie sensibly higher then the plain surface of the Sea. Againe, if the river move directly round, what should be the cause that begins and continues this motion? It is a motion besides the nature of the water, and therefore violent, what should drive it forward from the Sea to (C), and from (C) to (B)? When the water is at (C), or (W), it is as neere to the Center A as when it is at B, and therefore it should seem with more likelihood it would stand still; for why should it strive to goe farther, seeing where it is, it is as neere to the Center as whither it runnes. Or if some violence doe drive it from (C), towards (W) yet (as it is the nature of violent motions) the farther it goes the slower it will run, till in the end it stand still, if there be no advantage of ground to help it forward.

As a bowle thrown down a hill runnes easily and farre if it once be set a going; but thrown upon the ice (an even place) it will without any let at last stand still. Answer may be made hereunto, that although there be no advantage of the ground, yet the water will still move forward from (C) to (B) because the water that follows, pusheth forward, that which runs afore, which answer will stand, when a good cause may be shewed, which forcibly driveth the water from the Sea unto (C) and out of the fountain (C); considering that (after this supposition) they lie both in the same circular superficies. Wherefore seeing, we cannot without any inconveniency suppose it to move by any of these lines either straight as (BC) or (BD), or circular as (BWC) let us enquire farther.

The most likely opinion is, that the motion of the water is mixt, neither directly straight, or circular, but partly one, partly the other. Or if it be circular, it is in a circle whose center is a little distant from the center of the whole globe. Let us place fountains than neither in (C) nor (D) but in (F) I say the water runnes either partly straight by the (FS), and partly circular, from (S) to (B) which motion will not be inconvenient for the water descending continually from (F) to (S) will cause it still to runne forward; or else wholly circular in the circle (FXB.) And this is most

D

agreeable

5 mile. And so high shall the fountain stand above the mouth, and the surface of the plain land (for rivers commonly arise at foot of hills) which is (*BXF*) (swell up above the surface of the Sea (*BWC*) or (*BY*) which height of the land above the Sea although it be greater then is the height of the highest mountains above the plain Land, yet it is nothing in comparison of the whole Earth. And this being granted (as with more probability of reason it may) it will appeare that God in the beginning of the world imposed no perpetuall violence upon nature, in gathering together the waters into one place, and being so gathered, in keeping them from running back to cover the earth. At the first so soon as those hollow channells were prepared, the water did naturally slide downe into them, and out of them without miraculous power they cannot returne. For if the Sea (*BY*) should overflow the land towards (*F*) the water must send in running from (*B*) to (*F*) which is contrary to its nature. Certainly the midland countries, whence springs of great rivers usually arise, doe ly so high, that the sea cannot naturally overflow them. For as for that opinion that the water of the sea in the middle lies on a heade higher then the water that is by the shore ; and so that it is a harder matter to saile out of a Haven to sea-ward, then to come in (because they goe upward) : this is an empty speculation contrary to experience, and the grounds of nature it selfe, as might easily be shewed. All the difficulty that is in this opinion, is to give a reason how the waters mount up to *F* and whence the water comes that should flow out of so high a place of the earth, wherein I think as in many other secrets of nature, we must content our selves with ignorance, seeing so many vain conjectures have taken no better successe,

CHAP. IV.

Of the Circles of the Earth.

IN a round body as the earth is, there can be no distinction of parts, and places without the help of some lines drawn or imagined to be drawn upon it. Now there are not, nor can be any circles truly drawn upon the earth, yet because there is a good

ground in nature and reason of things from them, we must imagine them to be drawn upon the earth, as truly as we see them described upon a Globe or in a plain paper. Farther this must be noted, that all circles on the earth have the like oppositely unto them conceived to be in the heavens, under which they are directly situated. This known the circles that we are to take the speciall notice of are of two sorts, Greater and lesser.

The greater circles are those which divide this earthly globe into equall halves or Hemispheres.

The lesser are those which divide it into two unequal parts, one bigger, another lesser.

Of the former sort there
are foure, the

1. Equator.
2. Meridian.
3. Horizon.
4. Zodiack, or Eclipticke.

1. *The Equator or Equinoctiall line, is a line drawn just in the midst of the earth, from East to West, which compasseth it as a girdle doth a mans body, and divideth it into two equall parts, one on the North side, the other on the South. The two points in the earth that are every way farthest distant from it North, and South, are called the Poles of the earth, which do directly stand under the two like points in the Heaven, so called because the Heaven turns about upon them, as the Earth doth in a Globe that is set in a frame. This circle of the first and principall note and use in Geography because all measurings for distances of places and quarters of the earth are reckoned in it, or from it. It is called the Equinoctiall, because when the Sunne in the Heavens comes to be directly over that circle in the earth, the dayes and nights are of equal length in all parts of the world; mariners call it by a kind of excellency, *The line*. Upon the Globe it is easily discerned being drawn bigger then any other circles from East to West, and with small divisions.*

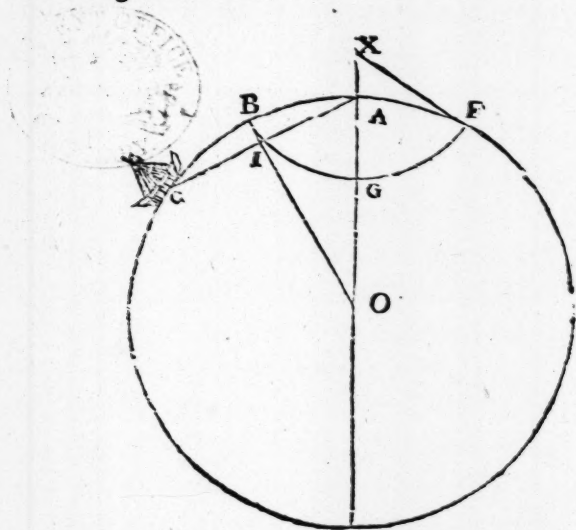
2. *The Meridian, is a line that is drawn quite crosse the Equinoctiall, and passeth through the Poles of the Earth, going directly North and South. It is called the Meridian, because when the Sunne stands just over that circle, it is Meridies, i. e. noon day. It may be conceived thus: At noon day, when it is just twelve a clock, turne your face towards the South, & then imagine with your selfe two circles drawn, one in the Heavens, passing from the North just over your head through the body of the Sunne*

Sunne down to the South, and so round under the earth up again to the North pole. Another upon the surface of the earth passing through your feet just under the Sunne, and so compassing the earth round till it meet at your feet again, and these are Meridians answering one to another. Now the Meridian is not one onely, as was the *Æquinoctiall*, but many still varying according to the place wherein you are, as for example: at *London* there is one Meridian, at *Oxford* another, at *Bristow* another, and so along Eastward or Westward. For it is noon at *London* sooner then at *Oxford*, and at *Oxford* sonner then at *Bristow*. Upon the Globe there are many drawn, all which passe through the Poles, and goe North and South, but there is one more remarkable then the rest, drawn broad with small divisions, which runneth through the Canary Ilands of *Azores* Westward of *Spaine*, which is counted the first Meridian in regard of reckoning and measuring of distances of places one from another; for otherwise here is neither first nor last in the round earth. But some place must be appointed where to begin the account: and those Ilands have been thought fittest, because no part of the World that lay Westward was known to the Ancients further then that; and as they began to reckon, we follow them. This circuit is called in Greeke *Μεσημβρια*.

3. The Horizon is twofold $\left\{ \begin{array}{l} \text{Sensible or appearing,} \\ \text{Intelligible or true.} \end{array} \right.$

*The Sensible or appearing Horizon is the space of the earth so far as in an open plaine, or upon some Hill a man may see round about him. The brim or edge of the earth farther then which you cannot see, that is the Horizon, or as some call it, the Finitor, because finit or terminat visum, it sets the limits or bounds to your sight, beyond which nothing can be seen upon the earth. This is greater or lesser, according as the height of the eye above the plain superficies of the earth, is more or lesse. The most exact triall hereof is at Sea, where there are no mountains nor any unequall risings of the waters to hinder the sight, as there are at land. For example let *CEAF* be the superficies of the Sea, and let a mans eye be placed in (*X*) above the Sea; as the eye stands higher or lower so will the distance seen be more or lesse, as if the height of *XA* be 6 foot which is ordinary the height of a man, the eye looking from (*X*) to (*B*) shall see 2 miles and 3 quarters*

ters, if (X) be 20 foot high (BA) will be five miles, if 40 foot 7 miles, if 50 foot 8 miles. So that from the mast of a ship 50 foot high, a man may see round about at sea 8 miles every way, toward (BG) and (F.) So farre may the water it selfe be seen, but any high thing on the water may be seen farther, 16, or 20 miles according as the height is, as the ship at (C) may be seen from (X) as far more as it is from (A) to (B.) There can be therefore no certain quantity and space set down for this sensible Horizon, which continually varies according to the height of the eye above the plaine ground or sea. This Horizon is not at all painted on the globe nor can be.



The intelligible or true Horizon is a line which girds the earth round in the midst, & divides it into two equall parts or Hemispheres, the uppermost, upon the top and middle point whereof we dwell, and that which is under us. Opposite to this in the Heavens is another Horizon, which likewise cuts the Heaven into two Hemispheres, the upper and the lower. Above which circle when any starre or the Sunne is moved, it then riseth unto us, and setteth unto

unto those that dwell opposite unto us, and so on the contrary. You may conceive it best thus, if standing upon a hill, or some open place, where you may perfectly see the setting of the Sunne, you mark when the Sunne is halfe gone out of your sight, you may perceive the body of the Sun cut in two, as it were by a line, going along through it, the halfe above it yet seen, that underneath is gone out of your sight. This line is but a peece of the Horizon, which if you conceive to be drawn upward about the World from the West to the North, and so by East & South, to West againe, you have the whole Horizon described.

This circle is not drawn upon the body of the globe, because it is variable; but stands on the outside of it, being a broad circle of wood covered with paper, on which are set the months and dayes of the yeare, both in the old and new Calender, and also the twelve signes, and the points of the compasse. All which are easily discerned by the beholding. The use of this Horizon is not so much in Geographie as in Astronomy.

The Zodiacke is a circle which compasseth the earth like a belt, crossing the Equator slopewise, not straight as the Meridians doe. Opposite to it in the Heavens is another circle of the same name, wherein are the 12 signes, and in which the Sunne keeps his own proper course all the year long, never declining from it on the one side or other. The use hereof in Geography is but little, onely to shew what people they are over whose heads the Sunne comes to be once or twice a yeare; who are all those that dwell within 23 degrees of the Equator; for so much is the declination, or sloping of the Zodiacke. This circle is also called the Ecliptick line, because when the Sunne and Moone stand both in this circle opposite each to other, then there happens an Eclipse of the Sunne, or Moone, upon a globe it is easily discerned, by the sloping of it from the Equator, and the divisions of it into 12 parts, and every of those 12 into 30 degrees.

These are the greater circles: the lesser follow; which are all of one nature, and are called by one generall name: sc. Parallels, because they are so drawn on each side of the Equator, as they are equidistant unto it every way. (as is ealie to be seen) and may be conceived to be drawn upon the earth; but there are only two sorts chiefly to be marked; namely the

{ Tropicks & the }
{ Polar circles }

The

The Tropicks are two parallel circles distant on each side of the Equator 23 degrees shewing the farthest bounds of the Sun's declination North or South from the Equator, or the middest of heaven. And therefore they are called tropicks a *trópos* veritendo, because when the Sunne comes over these lines, he either turns away from us, as in the Summer, or turns toward us againe as in the winter: There are then two of them, viz.

1. The Tropicke of Cancer which lies on the North side of the Equator, to which when the Sunne comes, it makes the longest day in Summer.
2. The Tropicke of Capricorne, lying Southward of the Equator, to which when the Sunne comes, it makes the shortest day in winter.

The Polar circles are two parallels drawn by the poles of the Zodiacke compassing about the Poles of the world, being distant from them every way 23 degrees.

1. The Arcticke circle that compasseth about the North Pole. It is so called because that in the Heavens (whereunto this in the earth lies opposite) runs through the constellation of the great Beare, which in Greeke is called *Axolis*.

2. The Antarcticke circle that compasseth about the South Pole, and is placed opposite unto the former. All these with the former are easily known upon the Globe by these descriptions, and names usually added unto them. But because Maps are of an easier price, and more common use then Globes, it will be needfull to shew how all these circles, which are drawn most naturally upon a round Globe, may also as truly, and profitably for knowledge and use be described upon a plain paper. Whereby we shall understand the reason of those lines which we see in the usuall Maps of the world, both how they are drawn, and wherefore they serve. Understand therefore, that in laying down the globe upon a plain paper, you must imagine the Globe to be cut in two halves thorow the midst, and so to be pressed down flat to the paper; as if you should take a hollow dish, and with your hand squeeze the bottome downe till it lie flat upon a broad, or any other plain thing: for then will those circles that before were of equall distance, run closer together towards the midst. After this conceit, universall Maps are made of two fashions, according as the globe may be divided two wayes, either cutting

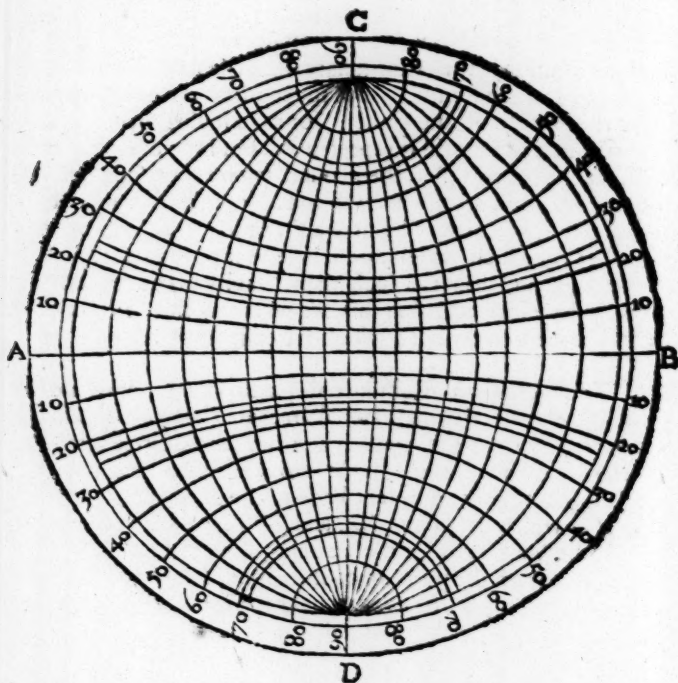
cutting quite through by the Meridian from North to South, as if you should cut an apple by the eye and the stalk, or cutting it through the *Æquinoctiall*, East and West, as one would divide an apple through the midst, between the eye and the stalk. The former makes two faces, or hemispheres, the East and the West hemisphere, the latter makes likewise two hemispheres, the North and the South. Both suppositions are good, and befitting the nature of the globe: for as touching such universal Maps wherein the world is represented not in two round faces, but all in one square plot, the ground whereupon such descriptions are founded, is lesse naturall and agreeable to the globe, for it supposeth the earth to be like a Cylinder (or role of bowling-allies;) which imagination, unlesse it be well qualified, is utterly false, and makes all such Maps * faulty in the scituation of places. Wherefore omitting this, we will shew the description of the two former onely, both which are easie to be done.

1. To describe an *Æquinoctiall* planisphere, draw a circle (*ABCD*) and inscribe in it two diameters (*AB*) and (*CD*) cutting each other at right angles, and the whole circle into foure quadrants; each whereof divide into 90 parts or degrees. The line (*AB*) doth fully represent halfe of the *Æquator*, as the line (*CD*) (in which the points (*C*) and (*D*) are of the two poles) halfe of the Meridian; for these circles, the eye being in perpendicular line from the point of concurrence, (as in this projection it is supposed) must needs appear streight. To draw the other, which will appear crooked, doe thus. Lay a rule from the Pole (*C*) to every tenth or fifth degree of the halfe circle (*AD*) noting in the *Æquator* (*AB*) every intersection of it and the rule. The like doe from the point (*B*) to the semicircle (*CAD*) noting also the intersections in the Meridian (*CD*). Then the diameters (*CB*) and (*AB*) being drawn out at both ends as farre as may suffice, finding in the line (*DC*) the center of the tenth division from (*A*) to (*C*) and from (*B*) to (*C*), and of the first point of intersection noted in the meridian from the *Æquator* towards (*C*) by a way familiar to Geometricians; connect the three points, and you have the parallel of 10 degrees from the

E

the

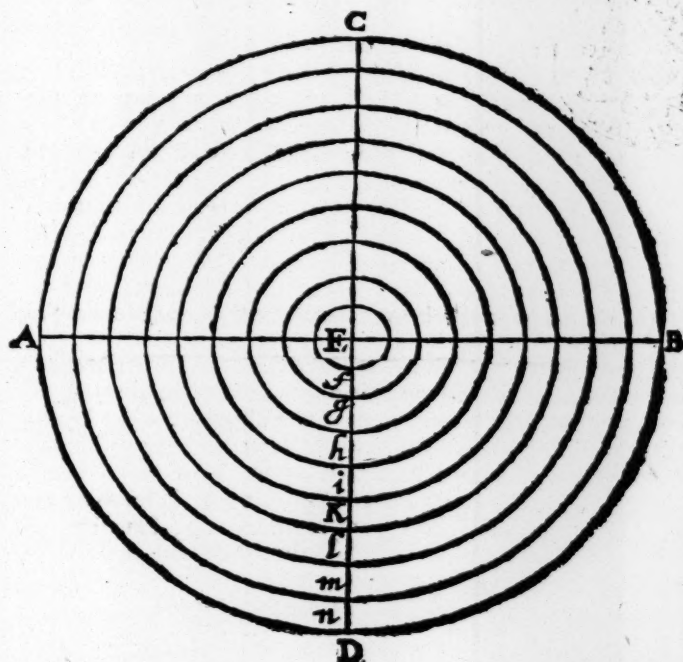
the Æquator: the like must be done in drawing the other pa-



rallels on either side of the Æquator; as also in drawing the Meridians from centers found in the line (AB) in like manner continued. All which is illustrated by the following diagram.

2. To describe a polar planisphere, draw a circle (ACDB) on the center (E) and as before, inscribe in it two diameters (AB) and (BC) cutting each other at right angles, and the circle into four quadrants. Each quadrant being divided into 90 parts, draw

draw from every 5th or 10th of those parts a diameter to the



opposite point : these lines all concurring in the center (E) being the pole, are as so many Meridians. Next, having cut the halfe of any one of the former diameters into 9 parts, as (ED,) in the points (FGHIKLMN) draw on the center (E) so many circles, and these represent the parallels of the Globe, being also here true parallels.

CHAP. VI

Of divers distinctions, and divisions of the earth.

NExt after the circles of the Earth, we may not unfitly handle the severall divisions & distinctions which Geographers make of the parts, and inhabitants of the earth. These are many, but we will briefly runne them over.

1. The first & most plain is by the coasts of the Havens, and rising, and setting of the Sunne, so it is distinguished into the

{ East; where the Sunne riseth. *Oriens, Ortus solis.*
 { West; where the Sunne goeth down. *Occidens.*
 { North; between both fromwards the Sunne at Noone. *Septentrio.*
 { South; between both towards the Sunne at Noone. *Meridies.*

These four are called the chiefe or Cardinall quarters of the world. They with the others between them are easily known, but are of more use to Mariners then to us. We may rather take notice of those other names which by Astronomers, Geographers, Divines, and Poets are given unto them. Who sometime call the East the right hand part of the world, sometime the West, sometime the North, and sometime the South, the diversity is noted in these verses.

Ad Boream vixit, Sed Calimen for ad Austrum.

Præco Dei exortum videt, occasumq; Poeta.

That is, Geographers look to the North, Astronomers to the South. Priests turne them to the East, and Poets to the West.

This serves for understanding of Authors, wherein any mention is made of the right or left part of the world. If for example he be a Poet, he means the South by the right hand, the North by the left; because a Poet turnes his face to the West, & so reckons the quarters of heaven and earth.

2. The second distinction is by the notable differences of heat & cold, that are observed on the earth, this is the division of the earth by Zones or Girdles, which are parts of the earth, wherein heat and cold doe remarkably increase or decrease. Those Zones are 5.

1. The hot or burning Zone (*Zona torrida*) which contains
all

all that space of earth, that lieth between the two Tropicks, supposed heretofore (but falsely as after experience hath shewed) to be inhabitable by reason of heat, the Sun continually lying over some part of it.

2. 3. The temperate Zones wherein neither heat nor cold is extream but moderate: these are two, one on the North side of the Æquator, between the Arcticke circle and the Tropicke of Cancer, another on the South side between the Tropick of Capricorne, and the Antarticke circle.

4. 5. The cold or frozen Zones, wherein cold for the most part is greater then the heat; these likewise are two, one in the North, between the Arcticke circle, and the North Pole, another on the South between the Antarticke circle and the South Pole. These of all parts of the earth are most inhabited, according as extremity of cold is alwaies a greater enemy to mans body, then extremity of heat.

2. The third distinction is by the shadowes, which bodies do cast upon the earth, just at noon-day; for these do not alwaies fall one way but diversly according to their diverse situation upon the earth. Now in respect of the shadowes of mens bodies, the inhabitants of the earth are divided into the

1. *Amphiscii* (*Amphiscii*) whose shadowes at noon day fall both waies, so to the North when the Sun is Southward of them, and to the South when the Sun is Northward, and such are those people that dwell in the hot Zone. For the Sun goes over their heads twice a yeare, once Northward, another time Southward. When the Sun is just over their heads they are called *Ascii*, *Ascii* without shadow.

2. *Heteroscii* (*Heteroscii*) whose shadowes do alwaies fall one way, namely alwaies towards the North: as those that dwell in the Northerne temperate Zone, or alwaies to the South, as those that dwell in the Southerne temperate Zone.

3. *Periscii* (*Periscii*) whose shadowes goe round about them: as those people who dwell in the two cold Zones, for as the Sonne never goes downe to them after he is once up, but alwaies round about, so do their shadowes.

4. The fourth distinction is by the situation of the inhabitants of the earth, compared one with another, who are called either.

1. *Perizci* (*Perizci*) such as dwell round about the earth in

one & the same parallell, as for example under the Tropick of Cancer.

2. *Antarci* (*Arctici*) such as dwell opposite to the former in another parallell of the same distance from the Æquator. As those under the Tropick of Capricorne.

3. *Antipodes* (*Arctici*) who dwell just under us their feet opposite to ours. 5. The first distinction is of the length and breadth of the Earth, and places upon it: these may be considered two wayes.

1. Absolutely, and so the

{ Longitude or length of the Earth is its circuit, and Extension from East to West.

{ Latitude or breadth of it, is the whole circuit and compass of it from North to South.

2. Comparatively, comparing one places situation with another, and so the

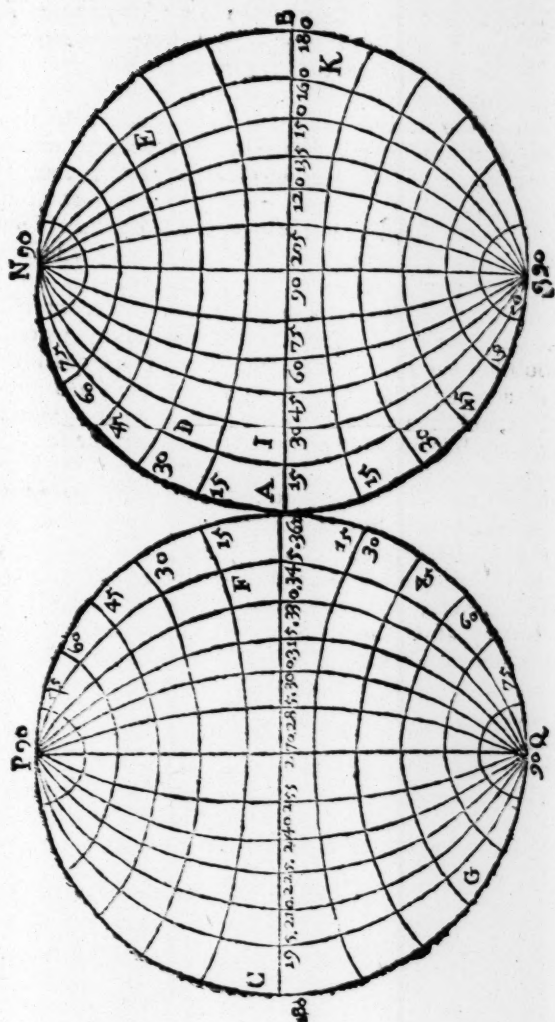
{ Longitude of a place, is the distance of it from the first Meridian going through the Canary Ilands, Eastward. Whereby we know how farre one place lies East or West from another.

{ Latitude of a place, is the distance of it from the Æquator towards the North or South. Whereby we know how farre one place lies Northward, or Southward of another.

The longitude must be reckoned by the degrees of the Æquator, the latitude by the degrees of the Meridian.

For example, in these two Hemispheres, the longitude of the whole Earth is from (G) to (A) & (B) in the Æquator. The Latitude is from (N) to (S), and from (Q) to (P) the North and South Poles, and this reckoned in any meridian. The first meridian is (ANBS) which goes by the Canary Ilands, the Æquinoctiall is (ABCA.) Now I have a City given sc. (D) I would know in what longitude and latitude it is. For the longitude I consider what meridian passeth through it, which is the meridian (NDS) which crosseth the Æquinoctiall in (I) at 15 degrees, wherefore I say that (D) stands Eastward from the first meridian 15 degrees. So I find that the City (E) is 150 degrees Eastward, (G) 195, and (F) 345.

For the latitude I consider what parallel runnes through (DEG)



(DEG) or (F) and I find the 30 to passe by (D) 45 by (E) the 15 by (F) the 45 Southward by (G) and those numbers are the latitude of the place, that are distant from the Æquator, (CAB.)

Concerning the means whereby the longitude of places is found out, there is scarce any thing that troubled Mathematicians so much as the observation of it. For because, no standing marke can be taken (the Heavens alwaies running about) it must needs be difficult. To measure upon the Earth, going alwaies under the same parallel, is a way certain in regard of some few places, but so troublesome in it selfe, and unprofitable in regard of other places that lie out of that parallel, that it may be accounted a fruitless labour. The voyages and accounts of Mariners at Sea, are so full of casualty and uncertainty by reason of the doubtfull variation of the compasse, the unequall violence of winds and tides, the false making of their Sea Cards, by which they faile, and the ignorance of the Masters for the greatest part, as there can hardly be any assured reckoning made by them. The best means of observation is by eclipses of the Sunne and Moone, which in severall countries are sooner or later seen, according as one place lies farther West from another. But this also falls out so seldome, and when it happens, is so seldome observed, and when it is observed, hath so many difficulties in the precise and exact observation of it; that we may well account this inquiry after the longitude of places, to be one of those things whereof we must be content to be ignorant, and rather to guesse at in grosse, then in vaine to strive for exactnesse, which is the cause why the tables of the longitude and latitude of Cities, though they many times agree in the latitude, doe yet for the most part very much differ in the longitude.

6. The sixth distinction is by the length or shortnesse of the day in Summer time in severall quarters of the earth. And this division is by climates (*κλιματε*) which are severall spaces of the earth contained between two parallels, in the which the longest day in Summer exceeds that in another parallel by halfe an houre. There is a great deale of confusion and difference between the late and ancient Geographers about the distinction and diverse reckonings of the Climates. It is not worth the labour to recount their opinions and Calculations: thus much is plaine, and easie to be known; There are 24 Climates, in which the day

day increaseth by halfe houres, from 12 houres to 24. There are likewise six Climats in which the day increaseth by months, from one month to fixe, that is halfe a yeare. Under the Æquator the day is alwaies twelve houres long, but as you goe from it towards the pole, the day lengthens still till it comes to a day, halfe a yeare long. Now in what degrees of latitude every one of these Climats beginnes and ends, shall appeare by this Table following.

The use of this table is easie. In the first Columnne are contained the names and number of the Climats. In the second the parallels which enclose it on each side, and divide it in the midst. For the parallels here are drawn by every halfe houres increase.

The third Columnne is the length of the day in Summer, in every Climate, which from 12 houres encreaseth by halfe houres to 24 houres, after by moneths, from one month to fixe.

The fourth contains the degrees of latitude, how farre every Climate lies from the Æquinoctiall.

The fifth contains the space or breadth of every Climate, how many degrees or minutes it takes up upon the Earth.

The sixth contains some notable places by which the Climates passe.

Hereby it is easie to know what the longest day is in any place of the world whose latitude is known. Or contrarily the longest day being known to know the latitude. For example *Oxford* hath latitude 52.0. degrees, longitude 24.0. In the table I find that 52 degrees of latitude, lie in the ninth Climate wherein the day is 16 houres and a halfe long, so much I say the day is at *Oxford* in Summer. The place of *Oxford* in the hzmispheare is at (V.)

Upon Globes the Climates are not usually described, but are noted out upon the brazen Meridian. So also in universall Maps they are seldome drawn, to avoid confusion of many lines together, but they are many times marked out on the limbe or edge of the map.

The seventh and last distinction of the earth is taken from the situation of it in respect of the Heavens, and especially the Sunnes motion. In regard whereof some parts or inhabitants of the earth, are said to be, or dwell in a right Spheare, some in a parallel

Those that dwell under the pole have not past 3 or 4 months profundas tenebras darke night, for when the Sun is in *Libra* & *Pisces*. being then night, the Horizon it sends forth to them a glimmering light not unlike to the twilight or dawning of the day in a morning a little before the Sun rising. *Munster. lib. 1. cap: 5.*

parallel spheare, and others in an oblique or crooked spheare.

They dwell (in *Sphæra recta*) in a right or streight spheare who dwell just under the *Æquinoctiall*, whose Horizon is parallel to the Meridians, but cuts the *Æquator* at right Angles.

They dwell in parallel spheares, who dwell just under either of the poles, whose Horizon is parallel to the *Æquator*, but cuts all the Meridians at right Angles: and the latter is sometime called a parallel spheare.

They dwell (in *Sphæra obliqua*) in a crooked spheare, who inhabite any place between the *Æquinoctiall* and the pole, whose Horizon cuts the *Æquator*, the parallels, and the Meridians at oblique or unequall Angles.

C H A P. VI.

Of the measuring of the Earth.

WE are now come to the last point concerning the measuring of the Earth, which is two-fold,

either of the { 1. Whole earth.
2. Severall parts thereof, and their distance one from another.

Concerning the first it is but a needlesse labour to recount the diversity of opinions that have been held from time to time by learned Geographers, what is the compasse and depth of the Earth. This may be seen in *Hues de usu Globi*, part. 3. cap. 2. & in *Clavius* on *Sacroboscus* with others. They all differ so much one from another, that there is no certainty in trusting any of them. The most common and received opinion is, that the circuit of the earth is 31600 miles, reckoning 60 miles for every degree, and then the depth or Diameter of the earth shall be 6377 English miles, containing 5000 foot in a mile.

The meanes whereby the circuit and Diameter of the earth are found out are principally two.

1. By measuring North or South, under one Meridian some good quantity of ground, threescore or an hundred miles (or two for the more certainty) for in those petty observations of small

small distances there can be no certain working. This may be done, though it be laborious, yet exactly without any sensible error by a skillfull workman, plotting it but upon his paper, with due heed taken that he often rectifie the variation of the needle (by which he travels) upon due observations, and that all notable ascents and descents, with such winding & turning as the necessity of the way causeth, be reduced to one streight line. By this meanes we shall know how many miles in the Earth answering to a degree in the Heavens, if exact observation by large instruments be made to finde the elevation of the Pole, in the first place where we begin to measure, and the last where we make an end.

Besides this way of measuring the circumference of the Earth, there is none other that hath any certainty of observation in it. That by Eclipses is most uncertain, for a little error in a few minutes of time (which the observers shall not possibly avoid) breeds a sensible and foule error in the distance of the two places of observation. That of *Erastosthenes* by the Sunne beames, and a shadow of a stile or gnomon set upon the Earth, is as bad as the other. For both the uncertainty of the calculation in so small quantity as the shadow and the gnomon must needs have, and the difficulty to observe the true length of the shadow, as also the false supposition whereupon it proceeds, taking those lines for parallels which are not, do manifestly shew the reckoning hereby made to be doubtfull and not sure.

2. The second is by measuring the semidiameter of the Earth: For as the circumference makes known the diameter, so doth this the circumference. This may be done by observation made upon some great hill, hard by the Sea side. The invention is of *Maurolycus Abbot of Messava in Sicilia*, but it hath been perfected, and more exactly performed by a worthy Mathematician *Ed. W.* who himselfe made proofe of it. By this art was the semidiameter of the Earth found out to be 18312621 foot: which allowing 5003 foot to a mile is 3662 and a halfe miles, which doubled is the whole diameter 7325 miles. The circuit of the earth shall be 23030 miles, and one degree contains $63\frac{63}{36}$ miles, which is almost 64 miles, which as it exceeds the ordinary account, so may we rest upon it as more exact then any other.

2. The second point concerning the measuring of particular distances of places one from another is thus performed.

First upon the Globe it is most easie. With a pair of Compasses take the distance between any two places howsoever situated upon the Globe, and apply the distance so taken to the *Æquator*, and see how many degrees it takes up; those degrees turned into miles shew the distance of the two cities one from another.

Upon universall Maps there is a little more difficulty in finding the distance of places, which here must be considered in a three-fold difference of situation:

1. Of Latitude only.
2. Of Longitude only.
3. Of Latitude and Longitude together.

1. If the two places differ only in Latitude, and lie under the same Meridian, if the places lie both on one side of the *Æquator*, the difference of the latitudes, or the summe of both latitudes added together, if one place lie North and another South, being turned into miles gives the true distance.

2. If the places differ only in Longitude, and lie both under one parallel of latitude, the difference of longitude turned into miles proportionably according to the latitude of the parallel, gives the true distance.

3. The distance of places differing both in latitude and longitude may thus be found out, first let there be drawn a semicircle upon a right diameter noted with *(ABCD)* whereof *(D)* shall be the center. The greater this semicircle is made, so much the more easie will be the operation; because the degrees will be larger. Then this semicircle being drawn, and accordingly divided, imagine that by the help of it, you desire to find out the distance betwixt *London* and *Jerusalem*, which Cities are known to differ both in longitude and latitude. Now that the true distance betwixt these two places may be found out, you must first subtract the lesser longitude out of a greater, so shall you finde the differences of their longitudes; which is 47 degrees. Then reckon that difference upon the semicircle, beginning at *(A)* and so proceed to *(B)*; and at the end of that difference, make a mark with the letter *(E)* unto which point by your ruler, let a right line be drawn from *(D)* the center of the semicircle.

micircle. This being in this sort performed, let the lesser latitude be sought out which is 32 degrees, in the aforesaid semicircle, beginning your account from the point (E) and so proceed towards (B,) and at the end of the lesser latitude let another point be marked out with the letter (G,) from which point, let there be drawn a perpendicular line which may fall with right angles upon the former line drawn down (D) to (E,) and where it chanceth to fall, there mark out a point with the letter (H:) This being performed let the greater latitude which is 51 degrees 52 minuits, be sought out in the semicircle beginning to reckon from (A) towards (B) and at the end of that latitude set another point signed out by the letter (I) from whence let there be drawn another perpendicular line that may fall with right angles upon the diameter (AC:) and here marke out a point with the letter (K,) this done take with your compasse the distance betwixt (K) and (H) which distance you must set down upon the diameter (AC) placing the one foot of your compasse upon (K) and the other towards the center (D,) and there mark out a point with the letter (L;) then with your compasse take the shorter perpendicular line (GH,) & apply that wideness upon the longer perpendicular line (IK,) placing the one foot of your compasse at (I,) which is the bounds of the greater latitude, and extend the other towards (K,) and there make a point at (M,) then with your compasse take the distance betwixt (L) & (M,) and apply the same to the semicircle, placing the one foot of your compasse in (A) and the other towards (B,) and there marke out a point with the letter (N) now the number of degrees comprehended betwixt (A) and (N) will expresse the true distance of the two places, which will be found to be 39 degrees: which being multiplied by 60 and so converted into miles according to the former rules, will produce 2340 which is the distance of the said places.

FINIS.

